

ROUNDUP

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Space Center

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In Chamber A of Building 32

Can plasma in space add to power systems

The ionospheric plasma has long plagued spacecraft engineers. At altitudes the Space Shuttle orbiter will fly is an environment of free flowing five-volt particles that can interfere or interface with spacecraft operations, especially space solar power systems.

In Vacuum Chamber A at JSC, engineers and scientists have just completed a series of tests on plasma interaction with spacecraft. After creating an ionospheric plasma using an argon thruster, they placed pieces of space hardware and materials into the chamber both to find ways to avoid damage to spacecraft and to investigate ways the plasma can be used as an augmenting power source for spacecraft.

At 65 feet in diameter and 120 feet tall, Vacuum Chamber A in Building 32 is the largest thermal vacuum test chamber in the country.

This series of tests ended in mid-July and scientists are now analyzing the data. Tests with other spacecraft power and communications systems will resume in the fall.

Until now space solar power arrays have been designed to operate at under 100 electron volts in order to avoid problems due to leakage currents through the surrounding space plasma.

NASA is now proposing space power systems that will operate at voltage values from 200 to possibly 2000 volts. These systems are scheduled to operate in Shuttle orbits where the thermal plasma environment (particle energies) is most dense.

Interaction between high voltage areas of solar arrays and the plasma environment is possible.

A Power Extension Package (PEP) test article hung inside the chamber last month while test engineers brought the ion density to that found at altitudes at which the PEP will fly. They then measured current leakage and voltage drops caused by the ionosphere at different densities.

The PEP solar array, which will be an augmenting power source for future Space Shuttle missions, will be the first of this new generation of lightweight high power solar arrays. These tests are the first time a flight-type solar array has been placed in a full scale space simulation, with both a thermal vacuum and a plasma environment. The PEP ran at 26 kw, its full rated solar power output.

"Operation of large solar arrays at high voltage in low Earth orbit drives leakage currents through

See Plasma Page 4

Apollo Soyuz

Splashdown was 5 years ago

Five years ago this week millions of Americans and persons around the world watched as three astronauts in a U.S. Apollo and two cosmonauts in a U.S.S.R. Soyuz merged their two spacecraft into a single vehicle.

The two crews shared meals, exchanged gifts, and conducted scientific experiments together.

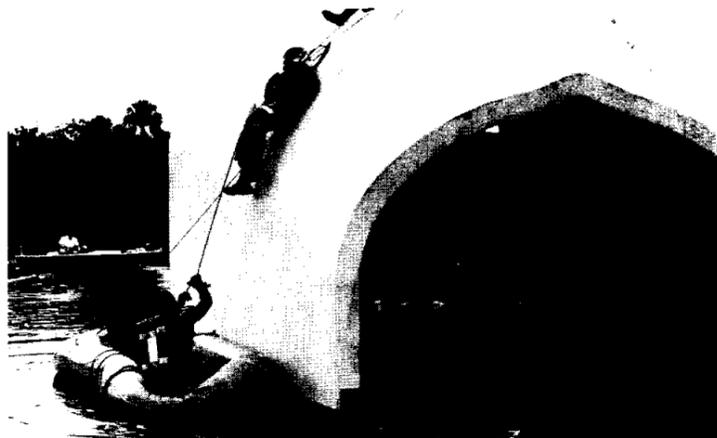
It was history's first international manned spaceflight, and

the first complex joint space project by the only two nations with proven capability to place men in orbit.

The undertaking was called the "Apollo Soyuz Test Project," and it splashed down at 17:19 EDT on July 24 after being launched on the 15th.

The American astronauts on-board were Thomas P. Stafford, Vance Brand, and Deke Slayton.

Yes, the exercise was carried out after the alligator was carried off



The rescue team was ready to begin a training exercise. A mockup of the orbiter was set down in a pond at the Kennedy Space Center site, and workers were about to run through rescue procedures should the Shuttle overshoot the runway on a return to launch site.

Then "Fat Albert" lumbered out of the pond. Fat Albert is an alligator who lives at the Cape and used to share lunches with KSC employees until a couple years ago when he ate an employee's tennis shoe right off his foot.

Fat Albert gallumped up the hill and stretched out to sun himself about 10 feet from the orbiter mockup—and the test had to be postponed. Officials called in wildlife officers who lassoed Fat Albert and dragged him out of the way.

In the meantime, the wildlife officers weighed Fat Albert (he's 1,000 pounds), and measured him (he's 13 feet 9 inches).

With Fat Albert out of the way, the maneuver continued. The rescue team dropped from a helicopter into the pond and rescued two dummy astronauts from the orbiter.

Walt Cunningham speaks at JSC

'Not once did anyone express doubt'

"You can count on one hand the persons in private industry who work with the dedication you find at NASA," said Walt Cunningham in a speech last week in Building Two Auditorium.

Apollo 7 Astronaut Cunningham was the first in a series of speakers taking part in Spaceweek '80 activities at the Center.

He spoke of his experiences since leaving NASA and going into private industry, and he related some anecdotes from his Apollo career.

"Most laymen do not appreciate the work that's going on at NASA," Cunningham said. "Even in Houston, and this is a space oriented city."

It shouldn't be that way, Cunningham, said, because "the Moon landing will be remembered as the event of the 20th Century. One thousand years from now poverty, depression, world wars—they'll be forgotten. But people will still be talking about the time man first stepped on the Moon."

Cunningham talked about the enthusiasm of NASA employees.

"Not once in my eight years at NASA did anyone express a single doubt about the success of the mission," he said.

People will always remember Apollo 11, but "Apollo 12 was certainly much more difficult," Cunningham said. "Pete Conrad had to land the module within walking distance of an unmanned spacecraft that had been sent up earlier."

Cunningham said Conrad's first words as he stepped on the Moon

See Cunningham Page 2

STS Update: Columbia gets one step closer

Another step toward the first launch of the Space Shuttle was taken this month with the successful completion of an Orbiter Integrated Test.

The test at Kennedy Space Center, which began on July 7 and was completed on July 14, was designed to check the way in which the various systems on-board Columbia operate together with computers, avionics, and ground systems. Principal among the systems being tested were the Orbiter's secondary propulsion system — the Orbital Maneuvering System — and its Reaction Control System, which will be used for attitude control.



Concept of orbiter reentry

Participating at various times in the test were Astronauts John Young and Bob Crippen and Joe

Engle and Dick Truly, prime and backup crews, respectively, for the first Space Shuttle mission.

Young and Crippen were in Columbia's cabin at 3 a.m. on July 10 for a simulated liftoff and ascent to Earth orbit and again at 3 a.m. on July 11 for the simulation of reentry, descent, and landing.

Completion of the integrated test brings Columbia one step closer to the day it will be rolled from the processing facility to the Vehicle Assembly Building. Among the tests ahead are the retest of the flight control system, dynamic stability tests, and structural integrity tests.

NASA and Rockwell engineers

last week completed tests of the microwave beam landing system.

Two of the main flight engines were scheduled for re-installation earlier this week, with the third engine scheduled to be placed back in Columbia early in August. The three engines successfully completed re-testing in June.

In other Shuttle activity, Marshall Space Flight engineers are in the process of studying data of the aborted full duration firing of the main test engines at NSTL in Bay St. Louis, Miss., on July 12. The test was aborted after 105 seconds when data indicated fire in the aft compartment of the orbiter simulator. The test was to

have lasted 542 seconds.

All engines and other aspects of the propulsion system apparently had functioned normally up to cutoff, and scheduled engine throttling and gimbaling had been accomplished as planned during that time. About 45 seconds of the firing was at 102% of rated thrust, and this was the first time for the three engine cluster to fire at this performance level.

Damage was confined to the one engine (#3) with no damage to the facility or the remainder of the test article, according to Marshall engineers. No date has been set for the next cluster firing.



What Makes the Mail Run?

They grab a stack and case it (sort it) then pull it for the route. The mail for one building goes across the room where they recase it for the runs. Then they tie up a bundle for each mail code. Work in the mail room is a constant pattern, with a rhythm and a propulsion system all its own. Bundles hang at the end of the room where a summer intern separates it by class, local, personal, and air mail. The stacks then go into the bag ready for the post office. On one shelf mail is separated by center—Ames, Headquarters, KSC—and at the end of the day they pack a priority box to each center. Downey's mail (Rock-

well) goes express each day. They keep track of parcel post and foreign mail, and "Run One and Two" is a section set aside for Building One mail—the secretaries come in often for it. One reminder to employees, make sure you use the *current* mail code, and when sending mail off site to a contractor, give the name of the company, not the building. (For more information, refer to NMI 1551.1G.) They sort it by contractor, or they sort it by mail code, then case it for each building. The swinging doors burst open and another cart comes in full of outgoing mail. They grab a stack and start to case it.



Cunningham, from Page 1

were a parody on Neil Armstrong's." At five feet seven inches and with the near 300 pounds of equipment he was wearing, that last step off the ladder was pretty hard for Pete," Cunningham said.

"When Conrad touched ground, he said, 'That may have been a small step for Neil, but it was a giant leap for Pete.'"

People often ask Cunningham what is the significance of man's

going to the Moon. "It's too early to put in perspective," he said.

"That's like going to Italy in 1505 and asking, What will be the outcome of Columbus' trip to the New World."

Some of the impact of the Apollo program can already be seen, however. "In the 1960's we staggered the imagination of a generation," Cunningham said. "We left the next generation taking spaceflight for granted."

That 'tall cool one' may only make you feel hot and thirstier

That tall cool one you just popped the top off may make you hotter rather than cooling you off in a heat wave.

When the temperature outside exceeds your body temperature drinking alcoholic beverages will cause you to absorb the outside heat.

The ethanol in alcohol causes peripheral vasco-dilatation, in other words it dilates the blood vessels on the skin and muscles. This causes more circulation near

the surface of the skin, and allows more area for heat to transfer from the outside into your body.

"In other words, don't drink alcohol out in the sun," says Dr. Joseph Degioanni of JSC's Medical Sciences Division. "All that circulation on the surface will pick up the heat. If it's hotter outside, the heat will flow from outside and heat you up."

In addition, alcohol dehydrates the body. "It draws fluid from the body like a sponge," Degioanni

said, "and makes you more susceptible to heat exhaustion."

So as the temperatures reach 100 plus it's better to take an ice tea plunge, or just chew the ice from the cooler and leave the cans alone.

The same thing, by the way, applies to cold weather—an alcoholic drink in winter may cause your body to absorb more cold from outside.

So there is no heat problem imbibing in an air conditioned room.

Cookin' in the cafeteria

Week of July 28 - August 1

Monday: Cream of Chicken Soup; Beef Burgundy over Noodles; Fried Chicken; BBQ Sausage Link; Hamburger Steak (Special) Buttered Corn; Carrots; Green Beans. Standard Daily Items: Roast Beef; Baked Ham; Fried Chicken; Fried Fish; Chopped Sirloin. Selection of Salads, Sandwiches and Pies.

Tuesday: Beef Noodle Soup; Baked Meatloaf; Liver w/Onions; BBQ Spare Ribs; Turkey & Dressing (Special); Spanish Rice; Broccoli; Buttered Squash.

Wednesday: Seafood Gumbo; Broiled Fish; Tamales w/Chili; Spanish Macaroni (Special) Ranch Beans; Beets; Parsley Potatoes.

Thursday: Navy Bean Soup; Beef Pot Roast; Shrimp Chop Suey; Pork Chops; Chicken Fried Steak (Special); Carrots; Cabbage; Green Beans.

Friday: Seafood Gumbo; Broiled Halibut; Fried Shrimp; Baked Ham; Tuna & Noodle Casserole (Special); Corn; Turnip Greens; Stewed Tomatoes.

Week of August 4 - 8

Monday: Chicken Noodle Soup; Weiners & Beans; Round Steak w/Hash Browns; Meatballs & Spaghetti (Special) Okra & Tomatoes; Carrots; Whipped Potatoes. Standard Daily Items: Roast Beef; Baked Ham; Fried Chicken; Fried Fish; Chopped Sirloin. Selection of Salads, Sandwiches and Pies.

Tuesday: Beef & Barley Soup; Beef Stew; Shrimp Creole; Fried Chicken (Special); Stewed Tomatoes; Mixed Vegetables; Broccoli.

Wednesday: Mushroom Soup; Fried Perch; New England Dinner; Swiss Steak (Special) Italian Green Beans; Cabbage; Carrots.

Thursday: Cream of Chicken Soup; Turkey & Dressing; Enchiladas w/Chili; Weiners & Macaroni; Stuffed Bell Pepper (Special); Zucchini Squash; English Peas; Rice.

Friday: Seafood Gumbo; Baked Flounder; 1/4-Broiled Chicken w/Peach half; Salisbury Steak (Special); Cauliflower au gratin; Mixed Vegetables; Whipped Potatoes; Buttered Cabbage.



Recent Suggestion, Tech Brief, and Invention Award winners

Bulletin Board

Come Hear the Houston Grand Opera

The Houston Grand Opera is offering corporate discount subscriptions to NASA employees and contractors. Obtain a special order form at the Building 11 souvenir shop. They will also be mailed with the summer catalog to Federal Business Association members. The form allows 20% off the regular subscription price or 50% off for senior citizens and students. Five operas will be presented in English in the Light Opera Series and six operas of the Grand Opera Series will be offered.

On Sale at the JSC Exchange Store

(Store Hours 10 a.m. to 2 p.m.)
Dean Goss tickets: \$10 single,
\$20 couple (reg. \$14.50)
ABC Theatre tickets: \$2 ea.
General Cinema tickets:
\$2.40 ea.
Astroworld tickets: \$8
(reg. 9.95)
Six Flags Over Texas discount
tickets
Magic Kingdom Cards: Free
Sea-Arama Marineworld Fun-
Time cards: Free

This Theatre Offer is Special for NASA Employees

The Nina Vance Alley Theatre Corporate Subscription Program is again being offered to NASA

Roundup deadline is the first Wednesday after publication.



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Editor..... Kay Ebeling

employees and contractors. Season tickets are available for next year's series of six performances at the low price of \$30 which may be charged on a variety of credit cards. Brochures and order forms are available at the Building 11 souvenir shop. They will also be mailed with the summer catalog to members of the Federal Business Association. Corporate Subscription coupon books will be home-mailed just prior to the opening of the '80-81 season in October.

NARFE August Meeting to Be At Armand Bayou Nature Center

The Houston-NASA Area Chapter 1321 of The National Association of Retired Federal Employees will meet on Wednesday, August 6, at 1 p.m. in the Armand Bayou Nature Center Building. Entrance is east of Bay Area Park on Bay Area Blvd. Following a brief business meeting, nature trail walks and a boat ride are scheduled. For more information, call Paul Vavra at 334-2978.

C. Ramirez earns award

Carlos Ramirez, of the Equal Employment office, will receive the Hispanic Employment Program Achievement Award at a ceremony tonight at Ninfa's Restaurant on the Gulf Freeway.

This evening's banquet will be the First Annual Awards Banquet for the Hispanic Employment Program.

The award is the highest given to an individual in recognition for outstanding contributions in furthering the goal of equal opportunity for Hispanics in the Federal Government.

Ramirez was selected to receive the Certificate of Appreciation for his devoted and invaluable services rendered to the Houston-Galveston HEPM Council. He served as the Council's Chair for 1979-80.

Training Credit Available For Toastmasters Members

Would you like to meet new exciting people, receive two extra hours for lunch (per month), improve your communications ability, and receive official government training for your efforts? All you have to do is fill out the NASA training form 75 and join the Spaceland Toastmasters Club. There you will meet ex-noncommunicators who are now very accomplished in several areas of communications skills. We meet at 11:30 a.m. every first and third Wednesday at Franco's Flying pizza, 1101 NASA Road One. For further information, please contact Emmitt Fisher at x3978 or Steve Jacobs at x3561.

Take a Bike Ride To Help Heart Association

The Clear Lake Chapter of the American Heart Association is holding its annual cyclothon fund raising event on 2 August 1980. It has been a great success in the past. Many NASA contractors have supported with team entries toward a traveling trophy. Last year's winner was Boeing Aerospace. There are numerous valuable prizes for those that earn the most money. These include Peugeot, Ross, and AMF 10-speed bicycles, and \$50 and \$25 savings bonds, to name a few. For information on entering, please contact Dr. Michael Berry, x4021 or 334-2303.

SIDE BY SIDE AN' STRIDE FOR STRIDE
WE CAN ALL WIN BY REPORTING OUR COST
REDUCTIONS (TO BE 3 ON JSC FORM 1150)



Cartoon by Russ Byther



Crippen runs exercise in single systems trainer

Playin' at Rec Center Specials for kids this summer

This just in from the Rec Center
Tickets are now on sale at the Exchange Store for the following Rec Center events:

JSC Dinner Theatre: Same Time, Next Year, a great comedy, is being offered for employees on four consecutive Fridays and Saturdays beginning July 25-26. Cost is \$10 per person (reserved seating) which includes the play, roast beef dinner, and beverages.

Parents' Break: Next two offerings for this Saturday morning family program are "Pinochio" on August 2, and "The Wiz" on August 9. Tickets are limited, so hurry and get yours now.

Childrens Theatre on the Bay: Two performances of the

great children's play, "Aladdin," directed by Claire Harmon will be offered at 7 p.m. on July 29 and 30 at the Gilruth Rec Center. Bring the whole family, as tickets are only \$.75 each.

Other News

Volleyball: registration is now being accepted for men's, women's, and mixed teams at the Gilruth Center. Cost is \$45 for EAA teams and \$90 for non-EAA teams. Deadline is August 4, 1980.

JSC vs. UHCLC: JSC emerged victorious in tennis by a final score of 3-2. In the battle for the trophy for 1980, JSC now leads 2-0. Softball is the next event.

Roundup Swap Shop

Ads must be under 20 words total per person, double spaced, and typed or printed. Deadline for submitting or cancelling ads is 5 p.m. the first Wednesday after publication. Send ads to AP3 Roundup, or deliver them to the Newsroom, Building 2 annex. No phone-in ads will be taken. Swap Shop is open to JSC federal and on-site contractor employees for non-commercial personal ads.

Property & Rentals

Rent: Lake Livingston resort 3 br lake front cottage, all amenity's. 554-6903 or x4207

Lease: Dixie Hollow/Pearland/Friendswood, 3-2-2, clean, 2 yrs old, den, fireplace, formals, \$475 mo. 482-1862

Rent: five minutes from NASA. 3 br cottage. \$295 mo. Horton. x5266

Sale: wooded waterview lot at Pt. Lookout on Lake Livingston, 75x137, utilities, restrictions, \$3750. 946-7587 or x6467.

Lake Livingston lot worth about \$2400, will sell or trade for best offer. T. Ward. 488-5445 after 6 pm.

Sale: by owner- 3-2-2 University Green Patio Home Spa with decking. Extras. 91/4% loan. 488-3377 after 5.

Rent: El Dorado 1 br condo. fire-place, electronic security system, washer, dryer, etc. 333-3734.

Rent: Vacation at Lake Livingston Cape Royale custom furnished home, 3-2-1 fish, ski, tennis, pool, golf, 488-4487.

Rent/Lease: Heritage Park, 3-2-2 imm & c throughout, separate DR, f'pl, draped, patio, lrg fenced yd, see to appreciate, \$475/mo; 474-4991 or 474-3887.

Sale: Country club lot at Lago Vista Estates on Lake Travis near Austin.

Rent: Lake Livingston Cape Royale Class A resort. Golf, tennis, marina, sacrifice, Steve x3561

3 br waterfront cottage by marina. Tennis, pool, golf, boat ramp. 3 day min. 488-3746.

Cars & Trucks

1979 Honda Hawk, 9000 miles, \$1500, good cond. Richard Guess 649-5092.

73 Mustang convertible, auto, ps/pb, air cond, am/fm stereo tape, new tape. \$3100 or best offer. 482-1535.

1972 Olds Delta Royale, good condition \$1200. 333-2759

73 Dodge mini-motor home, roof/dash a/c, sleeps 6, \$8000. Hegert x3977, 333-3716.

79 Berlineta Camaro, 32,000 mi, a/c, pb/s, am/fm stereo, cruise/tilt control, blue/light interior. \$5,700. Nanett night 649-4162 or day Ronda 483-7284.

1979 Toyota Corona, 4-dr station wagon; 16,800 miles; ac/heat, 5-speed, am/fm cassette radio, 481-1258.

78 Thunderbird, ps/pb, air, automatic cruise control, pwr seats, low mileage, excellent condition, \$3995, 488-5915.

1970 Chrysler, 9 pass, wgn, original \$450, 488-0035.

1978 Honda Hawk, 4000 mi. excellent condition. \$1300 481-2695.

1970 Dodge st. wagon, ps,pb. a/c, 383 v-8, air shocks, good cond, 140,000 mi. 1 ovr. \$500. 946-1895 after 6.

77 MGB convertible, red, 4 speed, clean, 23,000 miles - \$3,900.00 Negotiable. CALL 946-6419 after 5.

Household Articles

Solid teak fold-top desk with 3 drawers. \$15. Peter x3115.

JC Penney 20 cu. ft. chest freezer avocado green, exc. cond. \$150. Larson x5049 or 334-3432.

Boats & Planes

Bronze boat propellar, 13 inch dia. for 1 inch tapered key shaft, T-36. John 488-0559 or 4393.

For sale: low profile ski boat-Infinity. 15 ft, 1976 model with 85 hp Mercury outboard & galvanized trailer. Excellent cond. Dickinson 534-2476 \$2800.

Hang glider—18ft Zyper, helmet, harness, good condition. \$325 Flexible x5240, 480-2445.

Larson 15' ski boat. 73 Evinrude 135 hp w/tilt & trim, sst pro. galvanized tilt

trailer, runs good, needs front seats. Debbie 4321/488-0852 \$2500.

Stereos & Cameras

Zenith transoceanic all band radio-works \$25 Waite x4241 333-2442.

RCA 15" b&w portable tv, w/stand. Runs, but needs work. \$10. Merriam 488-3806.

Fisher FM-100 stereo FM tuner, tube type, walnut encl. good cond. \$30. 488-3996.

TEAC A360S cassette deck. Fully adjustable, bias /equalization with built-in oscillator. Excellent cond. \$250. Jeff x6385 or 480-2001 after 5.

Like new stereo 8-track radio. Listed for \$260 on 79 Mercury Capri. Best offer over \$50. Call Dot 334-2902.

Sony 19 inch color tv, model KV-1910, 114 degree wide angle trinition picture tube. \$400. John 488-0559 or x4393.

Musical Instruments

For sale: Cornet, olds ambassador, approved by Friendswood & Clear Creek schools. \$85. 488-0035.

Miscellaneous

Particle board, 5/8 in. \$3.00 per 4x8

sheet. Attic folding stairway \$25. Ward x2613 or 482-5255.

Mr. Meat Smoker-double rack used 3 times, \$27. John 488-0559 or x4393. Astros tickets for Aug. 20 Pitts game. ABWA selling for scholarships. \$5.00 Sprake x4183, Rodriguez x4708 or Maas x3647.

Transmission oil cooler suitable for extra cooling in van or pick-up. Sears model, never used. With instructions. \$10. 483-2626.

Wanted: PIANO call C. Biggs 487-2978.

LOST- tie clip J-57 P&W rec'd for work on DC-8 eng. installation, thought to be lost around or in bldg. 45 or 16. Please notify J. Fischer x2131 if found.

TRS 80 Level II 16k RAM computer with extra programs. \$700 or best offer 488-5445 after 6.

WANTED: Sport diving equipment, need buoyancy compensator, knife, depth gauge, dive watch, etc. Dick x4691 or 488-3288.

Carpools

Want a ride from LaPorte to NASA hrs 7:30 to 4. Loosmore x4176.

Want to join/form carpool from NASA area to Hermann Hospital. Depart area 6:45 - 7:15 am. non-smoker. 333-2395.

Want to join carpool from Galveston to JSC hrs:7:30 to 4. Jennifer x3025.



Scientists at Marshall experiment with acoustic levitation for suspending molten materials for processing in space. A sound wave levitator could hold free-floating material in a space furnace without use of a contaminating container.

Halley's Comet

ESA plans flyby mission

The European Space Agency has approved a project to send a spacecraft to Halley's comet.

The exploratory mission, which has been given the name Giotto, involves the spacecraft flying through the comet in 1986 at a speed of 70 kilometers a second.

The spacecraft, derived from the GEOS satellite, will have a payload consisting principally of a camera and mass spectrometers for measuring the atomic composition of the comet. Of a total mass of approximately 750 kg, it will be launched in July 1985 by Ariane into a geostationary transfer orbit (apogee: 35 700 km; perigee: 200 km).

The spacecraft will use its own motor to head for the trajectory of the comet, encountering the latter eight months later (March 1986) and performing a flyby of the

nucleus at a distance of less than 1000 km.

The Giotto mission takes its name from the "Adoration of the Magi" scene in the famous fresco cycle executed by the Florentine painter, Giotto di Bondone, that decorates the interior of the Arena Chapel, in Padua.

Halley's comet, which can be seen in the sky background of the Adoration scene, enters the inner part of the solar system about every 76 years, and one of its appearances was made in 1301. Giotto was consequently able to use it as a model for the star of Bethlehem when he painted the Adoration scene, which he completed in 1304.

In a way, Giotto's painting of this star can be considered as the first scientific description of Halley's comet.

NASA contract to reduce weight of external tank

NASA has signed a contract amendment which calls for reducing the weight of the Space Shuttle's external tank by 2720 kilograms from its present weight of 34,640 kg.

The change has the potential of increasing the Shuttle's payload carrying capability by almost the same amount.

The design change will apply to tanks built under a separate contract. The first lightweight external tank is expected to be delivered in the summer of 1982.

The external tanks are built by Martin Marietta at the Marshall Center's Michoud Assembly Facility in New Orleans.

Fuel cell could be power source for electric auto of the future

The fuel cell, which had its first practical application in the Gemini program as a power source for spacecraft, is now being used by the Department of Energy for possible development of an electric automobile.

At DOE's Los Alamos Scientific Laboratory, a fuel cell has been used to power an electric golf cart, and DOE engineers are applying the concept to four larger prospective vehicles: the city bus, the highway bus, individual cars, and delivery vans.

Fuel cells on the highways promise little or no emissions, virtually no noise, quick refueling, and an efficiency twice that of the gasoline engine. LASL's prototype cart runs on methyl alcohol and air, or hydrogen and air.

The chemicals power a conventional electric motor which moves the wheels.

The projected fuel cell car has a range of more than 400 miles, compared with 50-100 miles for battery cars. Methyl alcohol fuel would yield the equivalent of gas at 70 miles per gallon.

Fuel tanks could be filled readily, compared with an overnight recharge period for batteries. Fuel cells would provide a power range comparable to that of today's gasoline automobiles.

The fuel cell receives its "juice" potential from the outside in a continuous flow. On one side hydrogen enters at the negative electrode. On the positive electrode side, air or oxygen enters.

If methyl alcohol is used as

fuel, a reformer first breaks it down to hydrogen, one of its components. A porous carbon membrane in the fuel cell induces the hydrogen and oxygen to combine.

If hydrogen alone is the fuel, the only byproduct is water. Astronauts, since Gemini, use the fuel cell byproduct as drinking water. But hydrogen is more flammable and must be kept under pressure in metal cylinders.

Methyl alcohol run through a reformer provides hydrogen with water and carbon dioxide as byproducts. LASL scientists believe wood alcohol is a promis-

ing fuel candidate.

The only sound from the experimental golf cart is the hum from the blower motor, which keeps the components cool. LASL researchers project a sticker price for a fuel cell Volkswagen Rabbit at about \$7300.

Their experimental delivery van has a four horsepower motor with enough power to drive a Rabbit-type auto at moderate speeds.

Fuel cells would have a lifetime of about 6000 hours, and the price per unit would drop dramatically if demand stimulated mass production.

Plasma, from Page 1

the surrounding plasma," James McCoy, principal investigator for the project, said.

This results in power loss; however, use of the ionosphere could also result in power gain.

After the tests with the PEP, test engineers put objects of different shapes, sizes, and materials inside the chamber and subjected them to a variety of ion densities with various high voltages applied.

An ultimate goal of these tests is to find ways to make use of the ionosphere's free flowing energy. "Perhaps by biasing the payloads or configuring them differently, we could use the ionosphere to generate power or to adjust the spacecraft's attitude," said John Stanley, test director.

The ionospheric plasma is in the area surrounding the Earth from 50 to over 2000 miles altitude. It consists of free electrically charged particles created by ultraviolet rays from the sun. Its density varies with the altitude, time of day, season, and solar cycles.

Presently problems have been identified with manned and unmanned spacecraft charging or discharging as a result of interaction with the ionosphere.

"A goal of these tests is to find a way to have positive rather than detrimental effects caused by the plasma," Stanley said.

"This plasma provides a source of electric current carriers which can be very significant for large structures or power sources in space," McCoy said.

Space Voyage Night

'Tonight we are going to try something different we are going to see another side of the program'

"Tonight we are going to do something a bit different. We are going to open a few new windows and let you see another side of the space program, a view we too often forget: the Human side."

The soft voice of the narrator filled the darkened auditorium and "Man in Space," a NASA film came on the screen with a special soundtrack of music from recent science fiction films put together for Space Voyage Night.

Space Voyage Night took place Tuesday and Friday night of Spaceweek '80 at the Visitor Center.

People in the filled auditorium watched first orbital mission footage—watched the first space walks—watched the first cramped movements of astronauts in Gemini suits and capsules.

They then saw films from Apollo 9 and took a short tour of Jupiter's moons. But the highlight of the night was "Mars in 3D," a film where a viewer can appreciate the depths and ridges of Mars terrain and be surprised by a Viking crane reaching out into the audience.

"Reflections," a film based on



A Viking arm reached out

on the Apollo 9 space walk, gave the truly "human" side of space.

During the spacewalk "Dave's (Scott) camera jams and you have just a few moments with nothing to do. So you let go."

The astronaut on the film is then floating freely in space. "You look down and there are no limits to it," Schweickart says. "A silence contrasts with the speed at which you're going. Your identity keeps expanding.

"You realize you are a piece of a total life. You are up there as a sensing element for total man."

After a film about potential uses of the Shuttle, a viewer mused that the work with the orbiter will be much like the first spacewalks in near Earth orbit that were shown in the first films of the evening.

Outside the auditorium, members of the JSC Astronomy Club had telescopes set up for visitors to Space Voyage Night. And on Tuesday the 15th they had a special view: the moon occulted Jupiter in the eastern sky.

Space Voyage Night was a space film festival put on as part of the Spaceweek '80 activities last week. Viewers left with a new perspective on space and a new feeling for their identity with the solar system.